Unit 7
Waste Antifreeze Recycling

Antifreeze Properties

- **Base (≈95%) used for freeze & boil protection**
  - **Ethylene Glycol**
  - **Propylene Glycol**
- **Additives (≈5%)**
  - **Corrosion Inhibitors**
  - **pH Buffers**
  - **Anti-foaming Agents**

Antifreeze Environmental Concerns

- Ethylene and propylene glycols are manufactured from natural gas and crude petroleum, nonrenewable resources.
- Ethylene glycol is a toxic chemical
  - SARA Title III, Section 313
  - Section 66261.24(a)(8), 22 CCR
- Any waste antifreeze may contain heavy metals such as lead, cadmium, chromium, iron, copper, and zinc.

Recycling Technologies

- Distillation - produces clean glycol base
- Reverse Osmosis - filters out contaminants and additives, produces glycol and water
- Ion Exchange - removes ions (ie, chlorides, sulfates, additives) usually part of a process
- Chemical Treatment - flocculation, organic removal
- Filtration - removes contaminants, typically down to approximately 5 microns (sometimes to 1 or 1/2 micron)

Onsite Recycling Costs

On-Site Closed Loop (filtration or ion exchange)

- Capital Cost: $2,500 to $13,800
- Capacity: 4-5 gal/hr
- Filtration = $3 to $4.50/gal
- Ion Exchange = $4.45 to $7.20/gal

On-Site Batch (filtration or distillation)

- Capital Cost: $3,700 to $18,000
- Capacity: 4-100 gal/hr
- Recycling Costs: $0.74 to $4.50/gallon

Mobile and Off-site Recycling Costs

Mobile Service (filtration or reverse osmosis)

- Capacity: 55-210 gal/hr
- Recycling Costs: $1.75 to $3.00/gal

Off-Site Recycling (distillation)

- Capacity: 375-500 gal/hr
- Recycling Costs: $2.00 to $3.70/gal

Recycled Antifreeze Standards

- **Automobile & Light Duty: www.astm.org**
  - **Recycled antifreeze standards are ASTM 6471 & 6472**
  - **Similar to virgin antifreeze standards (ASTM 3306 & 5216) except for electrochemical pitting and storage stability tests**
  - **Must meet chloride and sulfate standards of 33 ppm and 140 ppm respectively, or complete fleet testing**
  - **User, not equipment manufacturer, must meet standard!**
- **Heavy Duty: www.astm.org**
  - **No recycled antifreeze standards at this time.**
  - **Virgin antifreeze standards are ASTM 6210 and 6211**

Recycled Antifreeze Standards

- **Dept. of Food and Agriculture - Division of Measurement Standards (916) 229-3000**
  - **Usually adopts ASTM antifreeze standards for those persons selling or distributing antifreeze in the State of CA.**
  - **Will adopt the new ASTM antifreeze recycling standards by January, 2002**
  - **Until adoption of new standards, existing CA. Law allows variance for chloride levels of up to 149 ppm if certain requirements are met.**
  - **References: Section 13710, Business and Professions Code, and Title 4, Division 9, Chapter 6, Article 7, Section 4161**

What About OAT?

- In 1999, about 30% of new passenger, 5% of heavy duty vehicles, factory-filled with Organic Acid Technology (OAT)
- OAT is glycol-based with long-lasting additive package
- OAT can be recycled, but chemical replenishment is critical

Case Study
USPS Huntington Beach

- 1,030 vehicles
  - 70 – 100 coolant changes/month
- Baseline
  - 2,250 gallons waste coolant/year
  - $18,900/year antifreeze purchase and disposal

Case Study
USPS Huntington Beach

Antifreeze recycling

- **Batch distillation unit: $8,500**
- **Additives, O&M: $4,310/year**

Payback Period: < 7 months

Take Home Messages

- Waste antifreeze can be recycled!
- Recycling costs are favorable
- Ensure recycled antifreeze meets ASTM or CA. Measurement Standards
- Ask Questions: See Antifreeze Recycling Factsheet